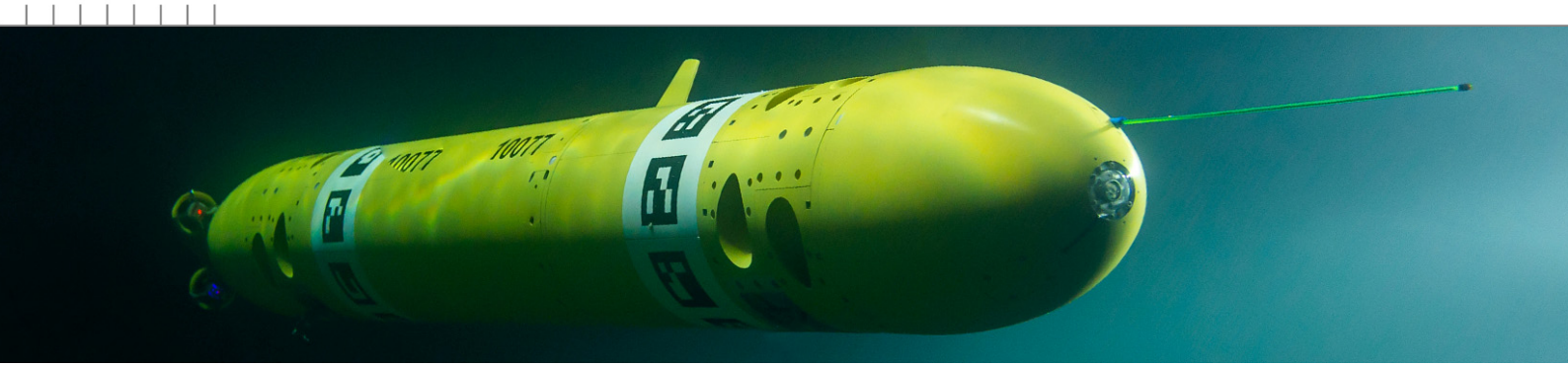
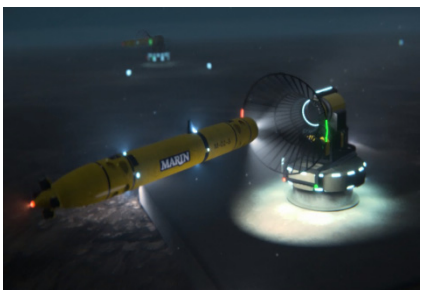


mAUV: A modular underwater test platform

MARIN has designed and built a modular underwater test platform to demonstrate current and future innovations in underwater vehicle control, propulsion and underwater position measurements. The objective is to show how a thorough understanding of hydrodynamics, validated simulation & calculation tools and advanced control can be used to develop new applications for underwater vehicles. The mAUV (modular Autonomous Underwater Vehicle) is designed as a flexible platform, both in hardware and software. Use case scenarios are jointly defined with the maritime industry and these drive the further development of this technology. Once demonstrated the conceptual developments can be taken further towards product development.

Stakeholders:

- Survey system developers & service suppliers
- Port authorities
- Navies
- Offshore companies
- Windfarm maintenance
- Maritime research
- Classification societies



Background

Autonomous Underwater Vehicles are already successfully deployed for inspection, reconnaissance and underwater maintenance in both the civil and the defence industry.

The development of the mAUV has been funded by MARIN's research and innovation budgets. The main objective was to design and construct a flexible test platform with unique capabilities. Reusing and further developing existing knowledge and technologies from MARIN's submarine and control research has been a starting point. This applies to simulation models, CFD, model test experience, measurement techniques, control, and estimation.

The result is an underwater test vehicle that can be adapted to the project's needs by adding payload modules, different actuator types or additional sensor modules. The technology and experience used to build the mAUV can also be used to develop new and different underwater concepts to demonstrate new, innovative ideas based on different use case scenarios. This can even be extended to innovative production methods and materials for the pressure hull.

Related MARIN experience:

- In the last decades MARIN has been involved in submarine concept development by simulations, CFD and model tests. This formed the basis for the mAUV developments.
- Advanced control applications: Dynamic Positioning systems, Autopilots, Ride control systems
- MARIN has extensive experience in developing maritime simulation systems. These systems are internally used for engineering studies, model testing in our facilities and for operator training on our full mission bridge simulator.
- Other MARIN test platforms are the C-drone (autonomous sailing wave buoy) and the MS Auris (autonomous sailing RHIB)

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Objectives

The objectives of this project are fourfold:

- To establish a design methodology for underwater vehicles that exploits MARIN's capabilities and the modularity of the mAUV platform;
- To develop a flexible underwater test & demonstration platform that can be used for underwater research in MARIN's facilities;
- To create a research platform where third parties can test and demonstrate concepts or products;
- To further develop control & estimation methods for underwater and on the surface vehicles.

Future plans and ideas

Further development steps will be driven by use case scenarios as defined together with the maritime industry. A JIP (Joint Industry Project) or similar could be an ideal way of cooperation on this topic. Examples of use case scenarios are:

- Continuous autonomous underwater harbour inspection and protection;
- Launch & recovery via torpedo tube or moonpool;
- Underwater inspection of quay walls, ship hull forms, propellers or anchor lines (floating wind turbines, FPSOs);
- Flexible mission planning & swarming;
- Littoral reconnaissance missions (combined with aerial drones);
- Free range fish herding / fish farm inspection;
- Underwater dredging.

Ideas for new functionality related to these use cases are:

- To increase the level of autonomy (add camera's, object detection, collision avoidance);
- To use cheaper, smaller sensors to reduce the cost per vehicle;
- To ruggedize the design for use outside the MARIN facilities;
- To improve the endurance (energy management, additional batteries, underwater charging, booster modules);
- Add manipulator tools.

The focus is primarily to further build upon the methods, knowledge, tools and experience developed within the mAUV project. Where possible the mAUV hardware will be used for future projects but this should not lead to limiting factors of any kind in which case redesigns will be required.

Please contact us if you have plans, ambitions or innovative ideas related to the above.